



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Rishabh Jain</b>	<b>Project Number</b>  33401
<b>Project Title</b> <b>From Fields to Fuels: A Comparison of Energy Content of Biodiesels Made from Waste Vegetable Oils</b>	
<b>Objectives/Goals</b> This project compares the energy content of biodiesels produced from different kinds of waste vegetable oils (soybean, canola, and corn). It was hypothesized that waste canola oil would have the highest energy content. <b>Abstract</b> <b>Methods/Materials</b> After the oils were filtered and warmed to remove suspended impurities and water, they were neutralized with potassium hydroxide (KOH). Equal volumes of oil samples were then treated with methanol and a catalyst, KOH, to create biodiesel. The biodiesel was separated from the glycerol byproduct and weighed. To determine energy density and total content, a calorimetry procedure was conducted in which the biodiesel was burned to transfer its energy in the form of heat to water. Using an energy conversion equation factoring increase in water temperature and decrease in biodiesel mass, the energy density for each biodiesel sample was calculated in Joules/gram. This energy density multiplied by the total mass of biodiesel produced determined total energy content in kilojoules. <b>Results</b> For the six calorimetry trials, the average energy density of canola biodiesel was almost 18,000 Joules/gram, surprisingly higher than commercial diesel fuel (15,000 Joules/gram), the control. Starting with 100 mL of waste oil, the total energy content of canola biodiesel averaged about 1,400 kilojoules, soybean had around 1,070 kilojoules, and corn yielded 900 kilojoules. <b>Conclusions/Discussion</b> The data collected proved my hypothesis correct, as canola biodiesel did have the highest energy content. Interestingly enough, every one of the three biodiesels released far less soot than diesel. In this investigation, canola biodiesel proved to be the best fuel source in terms of combustion cleanliness and energy content -- even when produced from used oil. At a macroeconomic level, the United States should invest in mass production and nationwide distribution of biodiesel to counter increasing dependency on diminishing fossil fuel reserves.	
<b>Summary Statement</b> This experiment investigates the energy content of biodiesels produced from three different common waste vegetable oils from restaurants.	
<b>Help Received</b> I would like to thank my parents for sourcing the chemicals used in this project, obtaining oil from several restaurants, and ensuring my safety during the burning of the biodiesels.	